OVERVIEW

To configure the Helium 100 series radios (He-100), operators are recommended to use the AstroDev He-100 Breakout Board and the He-100 Radio Configuration Program.

The He-100 Config Program was written by AstroDev specifically for configuring the radio to desired user settings. The program communicates with the He-100 Radio (Figure 1) over a serial interface through either a USB-to-serial or direct serial cable connection.

This document serves as a manual for configuring and testing a He-100 radio using the Radio Configuration Program V2.

Figure 1 – He-100 Radio

Applications:

- **Systems Integration**
- **Prototype Development**
- **Demonstration Programs**

Features:

- **Configure All Models of AstroDev Radios**

For more information, contact:
info@astrodev.com

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SETUP

To configure the He-100 Radio a desktop/laptop computer should be used as host. The radio and computer communicate over the 3.3V level UART interface. The following list of equipment is required and can be ordered at www.astrodev.com/public_html/node/20

- power supply (a computer power supply is recommended) (AD Part #ATXPOW-01)
- a USB mini-B to USB standard A cable or FTDI cable (AD Part #TTLUSB-01)
- the AstroDev He-100 Breakout Board, (AD Part #BRKOUT-1)
- an Antenna, (AD Part #RD434ANT-01)
- He-100 UHF/VHF radio, (AD Part #He-100)
- Radio Configuration Program: http://www.astrodev.com/public_html2/downloads/programs/He-100_Config_ProgramV2.zip

Computer Power Supply

A standard ATX computer power supply can be adapted for powering the radio for operation and specifically for configuration. In ATX power supplies, yellow indicates +12 V, red indicates +5 V, orange indicates +3.3 V, and black indicates GND.

The AstroDev He-100 Breakout Board features a male Molex connector for connecting the power supply. To mate, users should use the corresponding AstroDev part, or a computer power supply should be adapted so that the pins match the breakout board pinout. The plug is a 4-pin peripheral connector plug, Molex 8981 series power connector. Standard ATX power supplies order color coded wires yellow, black, black, red sequence corresponding to +12V,Ground,Ground,+5V. The wires should be rewired so that, from left to right, the lines to the connector are red, orange, black, red. The last red connects to VBATT, and its intended value is between 5 and 9 volts. The Molex connector can be avoided if banana plugs are preferred.

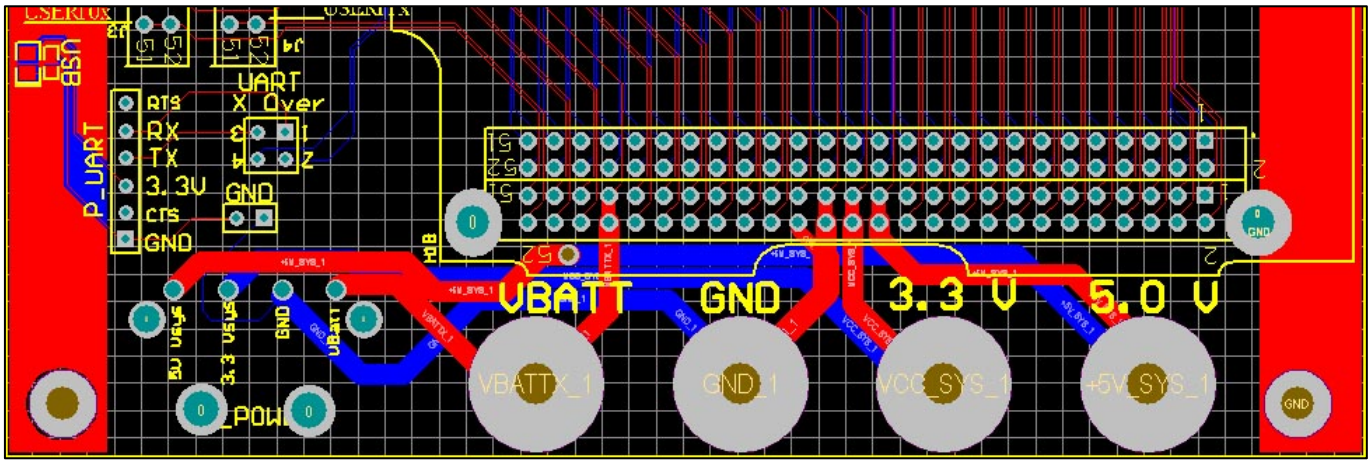


Figure 2 Board Layout Power Interface Description

The PCB layout above in Figure 2 shows the pin locations and voltages needed to interface to the ATX power supply for demonstration operations.

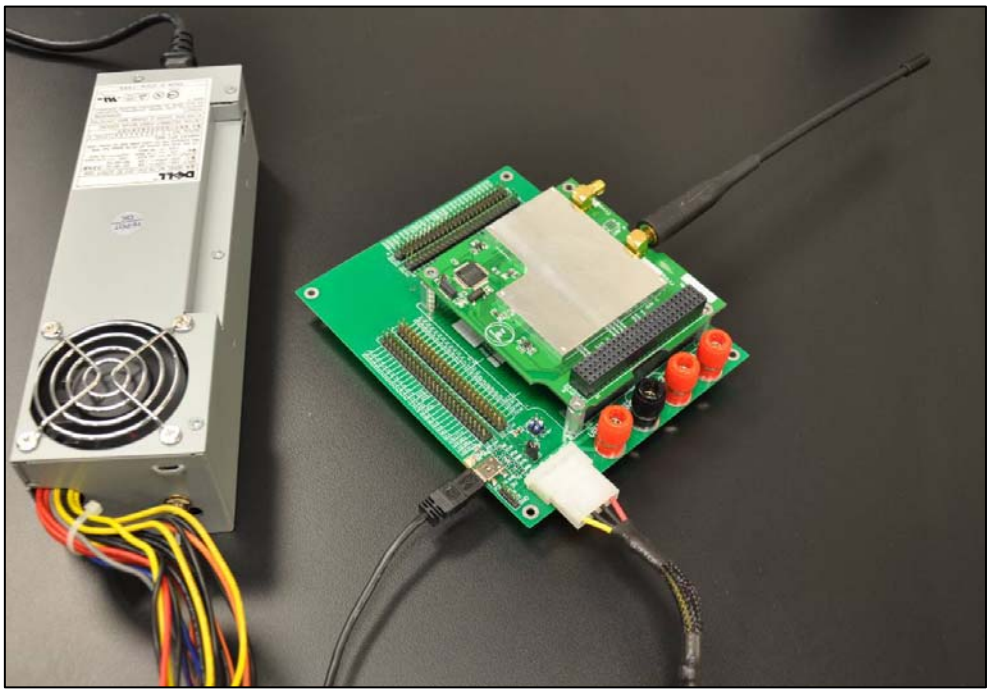


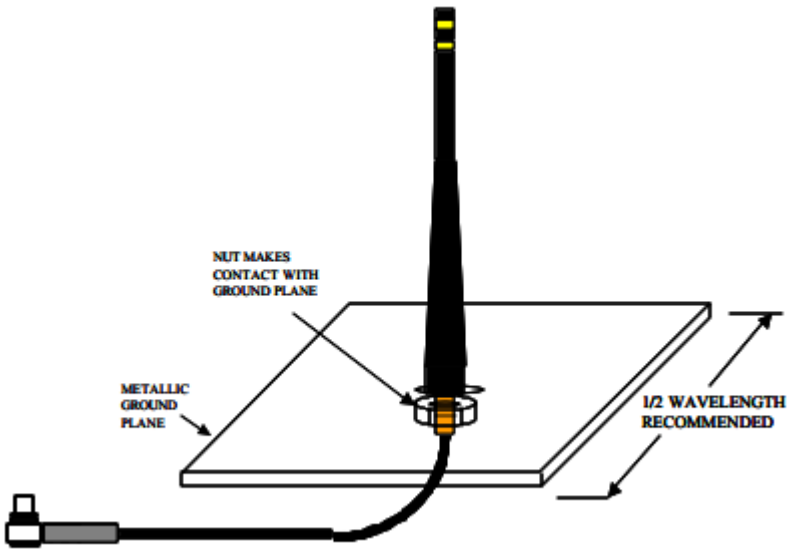
Figure 3 – Setup for He-100 Radio Configuration

Connections

After the power supply has been modified for radio configuration, the Molex connector and the power cable to the power supply can now be plugged in. The radio plugs into the breakout board as shown in Figure 3. A 50 Ohm whip antenna is quick and easy to use while configuring. The USB cable should then be connected to the breakout board and the computer where the He-100 Radio Config Program is installed.

Antennas

For link testing within a laboratory a recommended antenna is a monopole on a ground plane. See figure below.



RADIO CONFIGURATION PROGRAM

AstroDev has focused on implementing products that are user friendly and supported in both the hardware and software areas. To further ease the integration of our radios into CubeSat platforms AstroDev has developed a configuration program that can communicate with the each radio over a serial interface. Therefore to use this program, the user needs a USB to UART driver (Virtual Comm Port, VCP) installed in their computer. Typically, computers will automatically recognize and install the drivers.

The Radio Configuration Program has three tabs: a Comm Setup Page tab, a Configuration Page tab, and a Communications Page tab. The tabs are ordered sequenqially for configuration.

Tab 1 – Comm Setup Page

The first tab of the Configuration Program is the “Comm Setup Page” tab, Figure 4. The communications setup page allows the user to select the interface baud rates and the Windows comm port that correspondes to the serial interface. The He-100 Breakout Board features a USB mini B port to connect to a computer and can be used as long as the USB to serial UART drivers mentioned above are installed.

When a VCP is installed, it may be installed higher than the preferred range of comm ports 4 – 9. It is recommended that the user checks to make sure that their He-100 Breakout Board interface VCP hasn’t been assigned to a comm port higher than 9. This can be checked by navigating to Windows’ device manager. Once inside the device manager, the comm port can be changed by right clicking on the desired comm port; then properties. Inside the port properties, selecting the port settings tab, then the advanced button will give the user the option to manually change to a different comm port number.

Should add picture with highlight bubbles on each button click probably…
Or if you want you could make a quick video capture of the process and I can place it on my web page, probably easier.

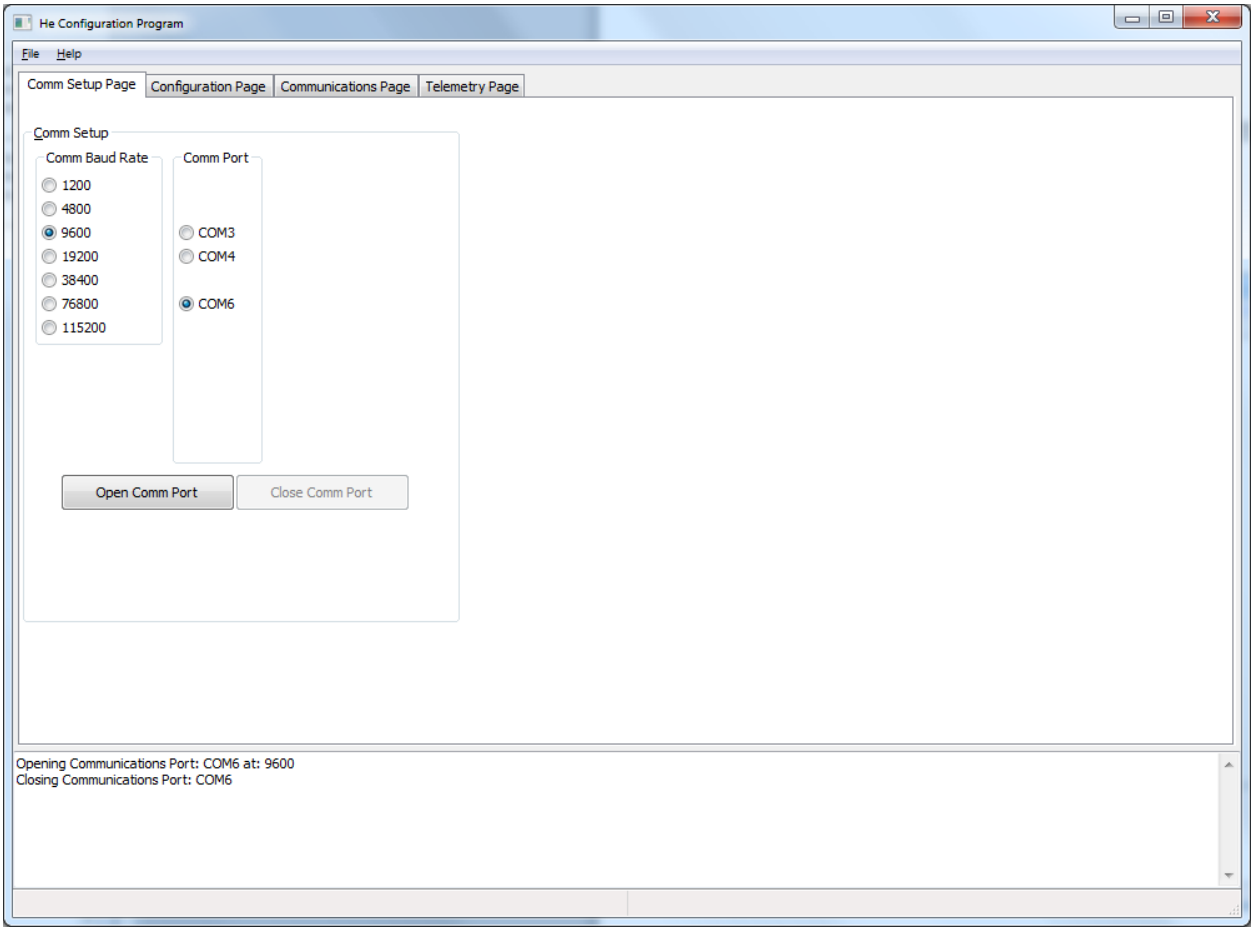


Figure 4 – Configuration Program – Comm Setup Page

Tab 2 – Configuration Page

The second tab of the Configuration Program is the configuration page – shown in Figure 5. The configuration page allows the user to setup the radio. Two buttons, “Read Radio Configuration” and “Write Radio Configuration” communicate with the radio to either read or set the radio settings, respectively. The “Read Radio Configuration” button will automatically update all of the radio buttons on the “Configuration Page” tab based on the current settings of the radio. The RF and interface baud rates, source and destination call signs, transmit delay and delay end, radio interface mode, and transmit and receive frequencies should be set here. After choosing all of the proper settings, the “Write Radio Configuration” button will apply settings to the radio.

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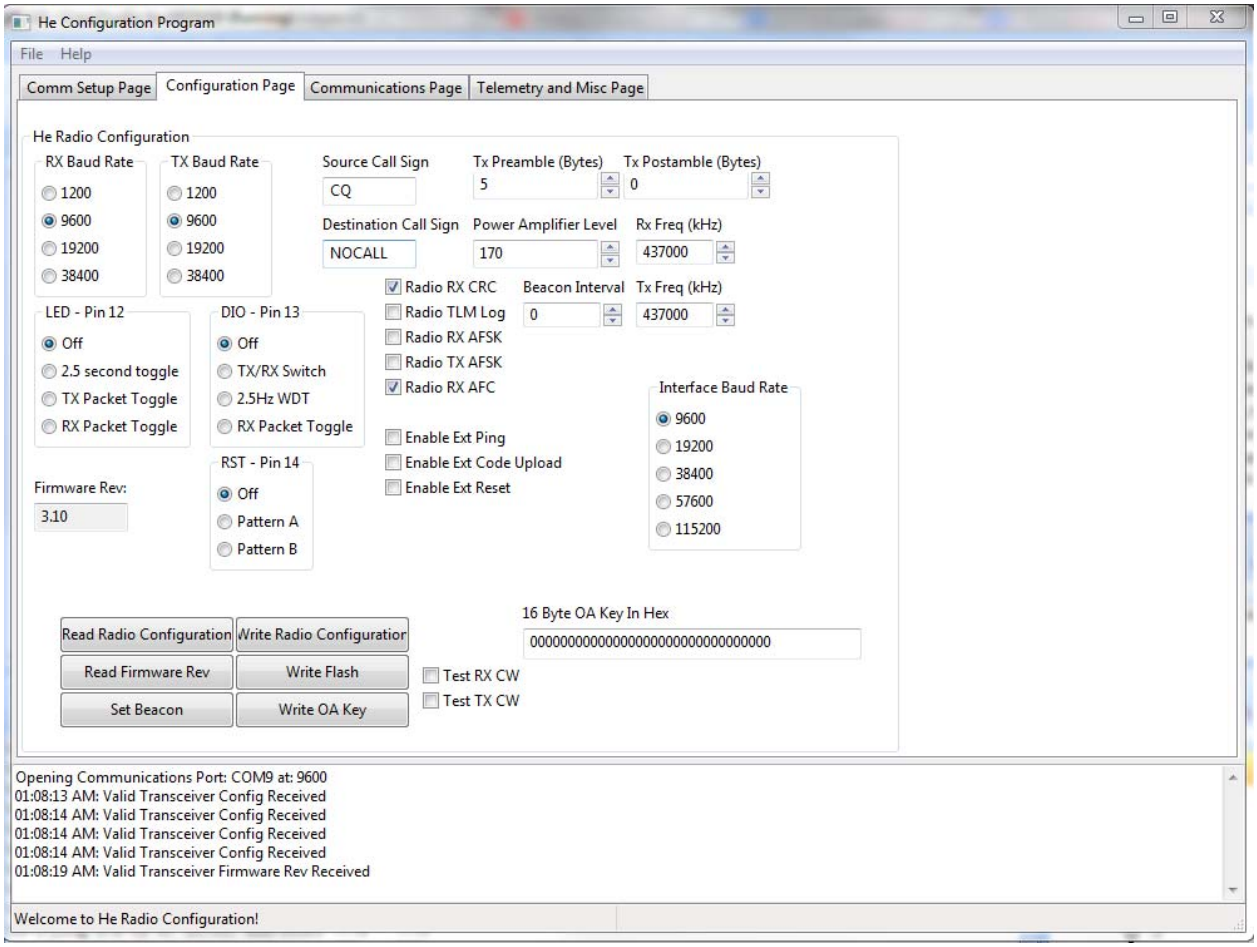

Figure 5 – Configuration Program – Configuration Page

Tab 3 – Communications Page

The third tab of the Configuration Program is the “Communications Page” tab, Figure 6. The communications page allows the user to transmit data to and from the radio in different modes. There is a transmit window and receive window that display ASCII information. The transmit window allows the user to enter information in TNC mode and transmit packets using the enter key. The buttons across the bottom of the page allow the user to send binary mode packets that are predefined.

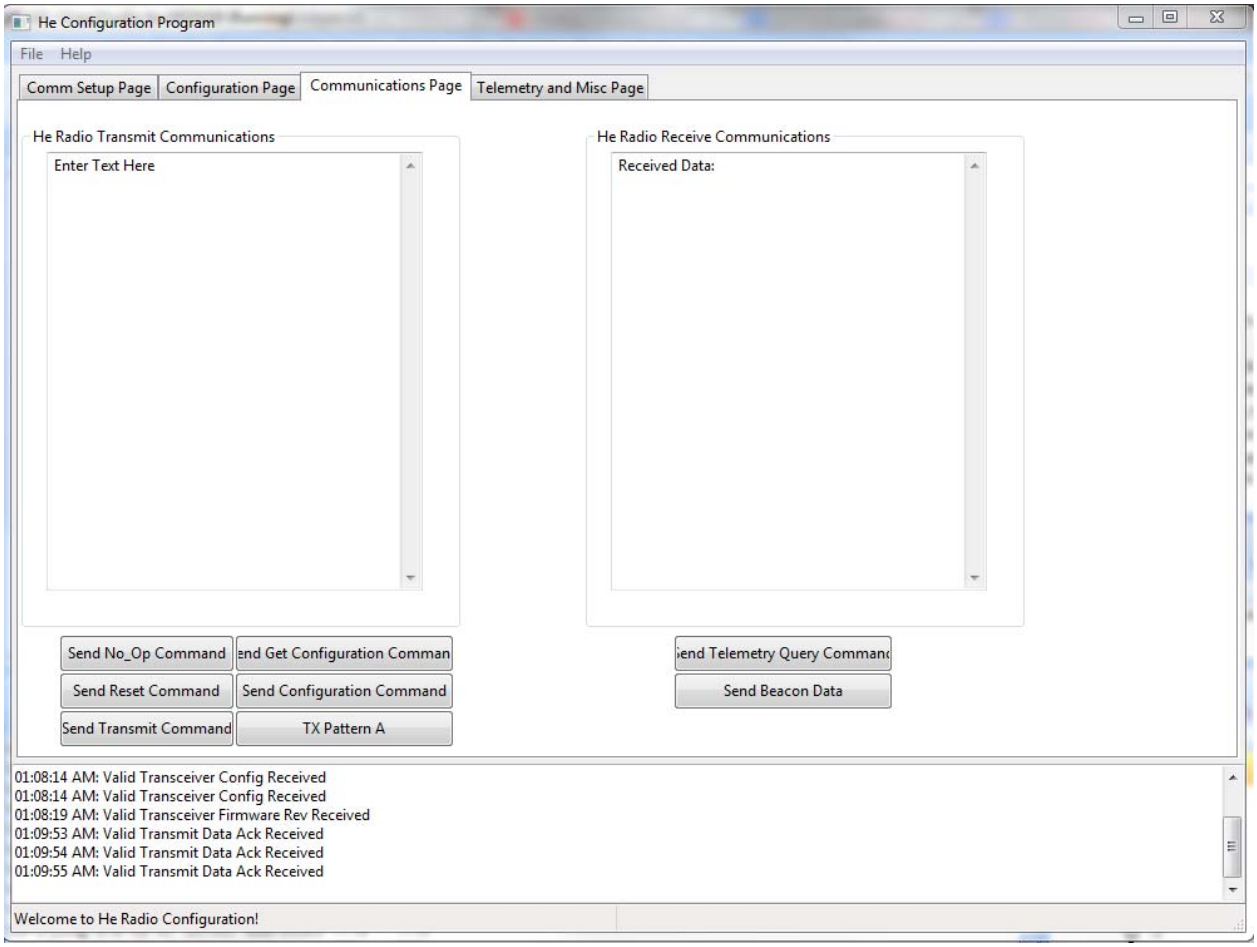
He Configuration Program
File Help
Comm Setup Page
Configuration Page
Communications Page
Telemetry and Misc Page
He Radio Transmit Communications
Enter Text Here
He Radio Receive Communications
Received Data:
Send No_Op Command
end Get Configuration Comman
Send Reset Command
Send Configuration Command
Send Transmit Command
TX Pattern A
end Telemetry Query Comman
Send Beacon Data
01:08:14 AM: Valid Transceiver Config Received
01:08:14 AM: Valid Transceiver Config Received
01:08:19 AM: Valid Transceiver Firmware Rev Received
01:09:53 AM: Valid Transmit Data Ack Received
01:09:54 AM: Valid Transmit Data Ack Received
01:09:55 AM: Valid Transmit Data Ack Received
Welcome to He Radio Configuration!

Figure 6 – Configuration Program – Communications Page

Tab 4 – Telemetry Page

The fourth tab of the Configuration Program is the “Telemetry Page” tab, Figure 7. This tab of the Configuration Program allows the user to request the preloaded telemetry on the radio: the count of the radio operations, the processor temperature on the radio, the Received Signal Strength Indication (RSSI), and the rest of the fields shown in the tab. In Figure 7, the last lines at the bottom of the window indicates what will be shown upon a successful read of the radio’s telemetry.

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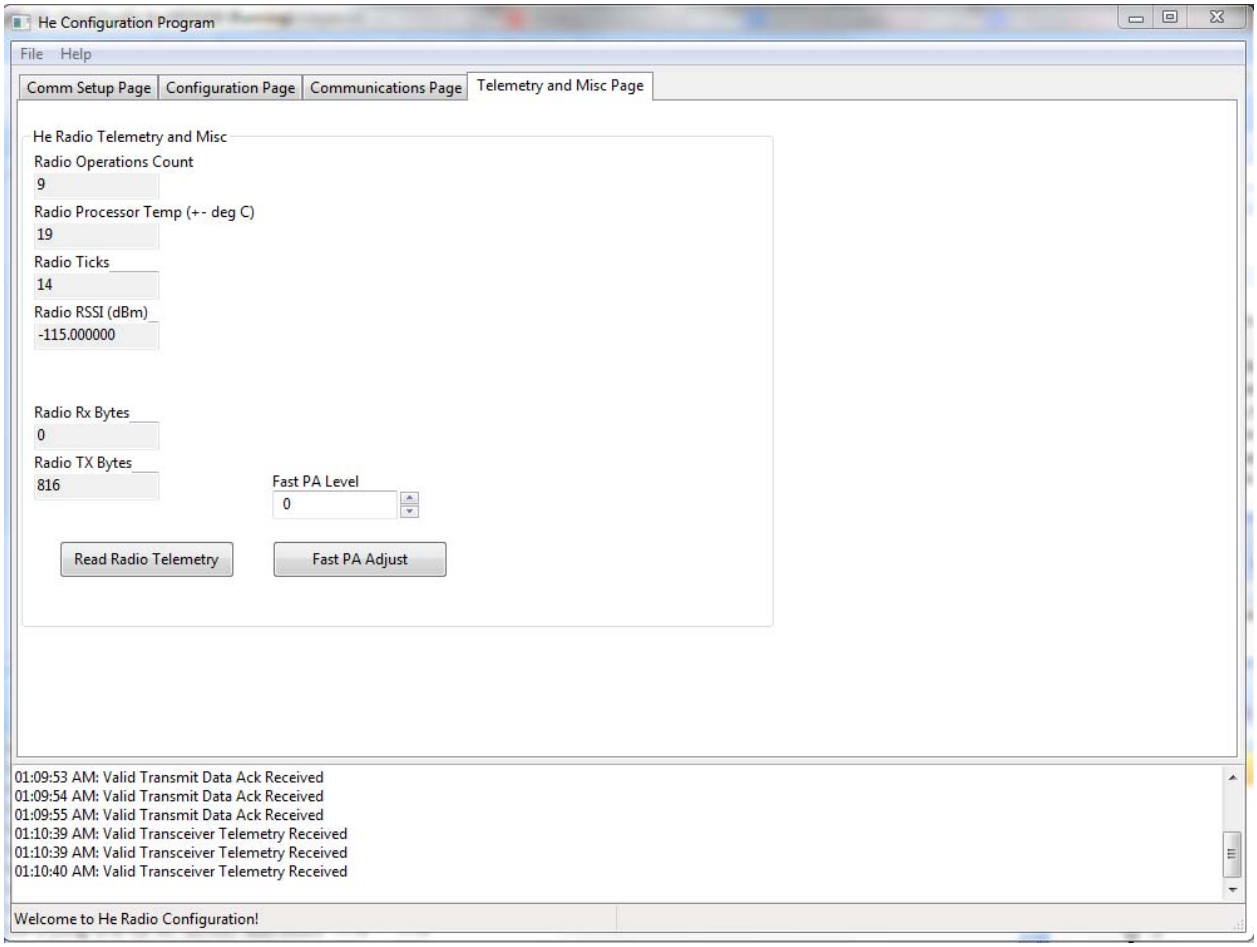

Figure 7 – Configuration Program – Telemetry Page

COMMUNICATION TESTING

With the setup described previously for the He-100, radio communication can be easily tested by communicating back and forth with a handheld transceiver and terminal node controller (TNC). Many handheld transceivers feature a built-in TNC. For testing purposes, a Kenwood TH-D7 is an example one such radio. The handheld should be connected to the computer so that a software terminal emulator can be used to transmit and receive through the radio serially. This can be achieved for most handhelds with TNCs by connecting a 2.5 mm TRS to RS-232 Female DB9 cable in series with an RS-232 DB9 Male to USB UART Bridge. With this chain connected, the analog audio signal can be sent to and from the computer through a VCP since the radio is connected to the computer via USB port.

Step 1 – Open Comm Port

The He-100 must be properly configured in tab 1 of the configuration program in order to begin transmit and receive testing. The first step is to open the comm port (COM#) that has been associated with the He-100 at desired baud rate. Figure 4 is a screen shot of the messages that should appear when opening and closing the comm port(s). The number of the comm port can be found by browsing through the Device Manager's ports.

Step 2 – Read Radio Configuration

The next step in testing the radio's communications is to read the radio's current configuration by clicking the "Read Radio Configuration Button." This option will update all of the 'radio buttons' on the Configuration Page tab of the program to display the radio's current configuration. If the radio's current configuration cannot be read, it may be

due to selecting the wrong comm port to open on the previous step. Figure 8 shows the responses generated by the radio when the configuration request is successful versus unsuccessful.

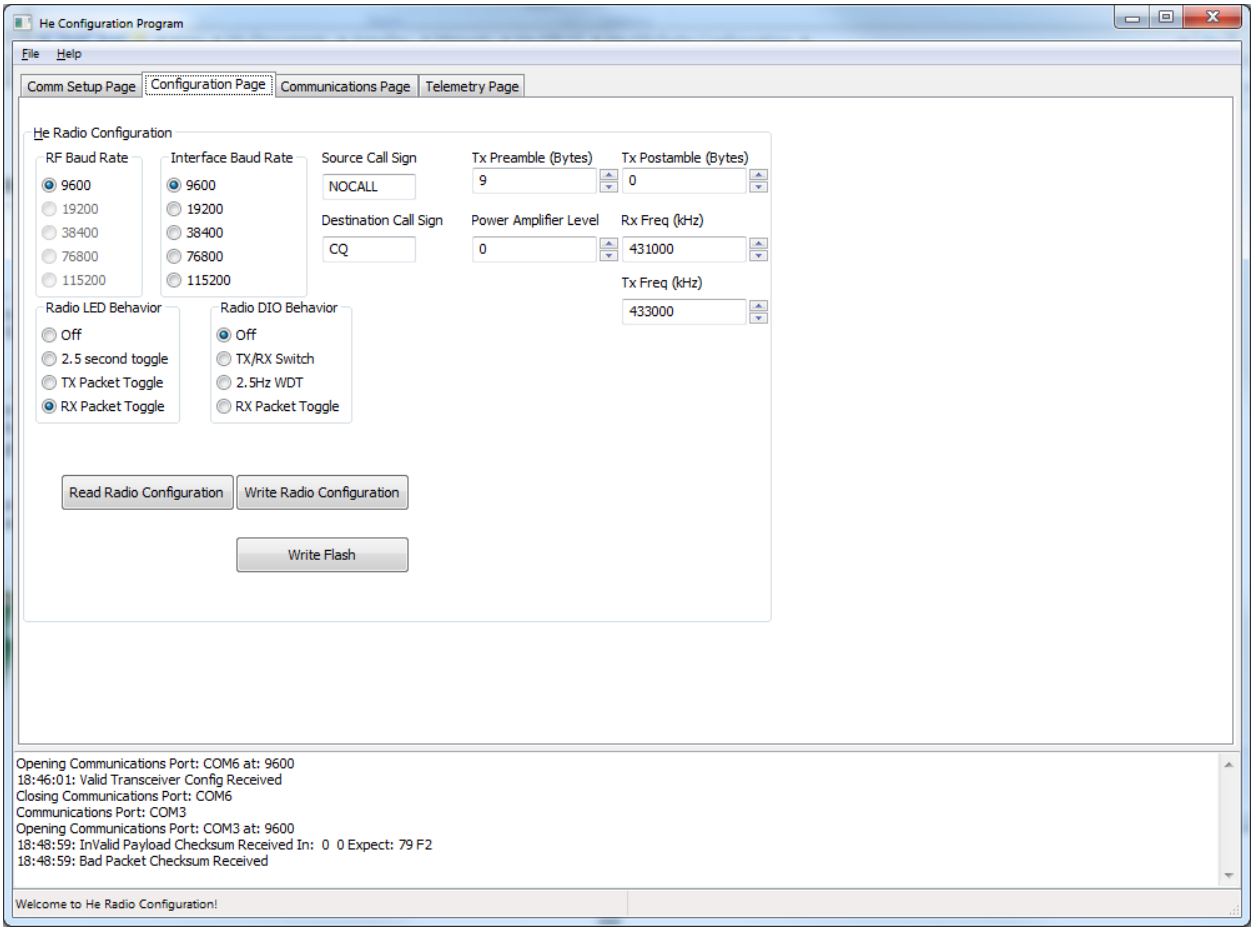

Figure 8 – Configuration Program – Valid / Invalid Read Configuration

Step 3 – Write Radio Configuration and Write Flash

After reading the radio's configuration, the user can configure the radio by altering the options on the Configuration Page tab. To apply the settings to the radio, the user should always click "Write Radio Configuration" prior to clicking "Write Flash." This order will insure that the configuration is stored to RAM, then moved to flash. The applied settings will now be retained by the radio, even if power to the radio is cycled. An example of the response generated by the radio for a successful "Write Radio Configuration" and "Write Flash" is shown in the last two lines at the bottom of Figure 9, respectively. If for any reason the message shown in Figure 10 is displayed, then the configuration was not successfully written to the radio and there was an issue with the attempted settings. In Figure 10, the "Rx Freq (kHz)" field was intentionally set below the values the receiver was capable of to issue the Nack shown as an example of an unsuccessful write.

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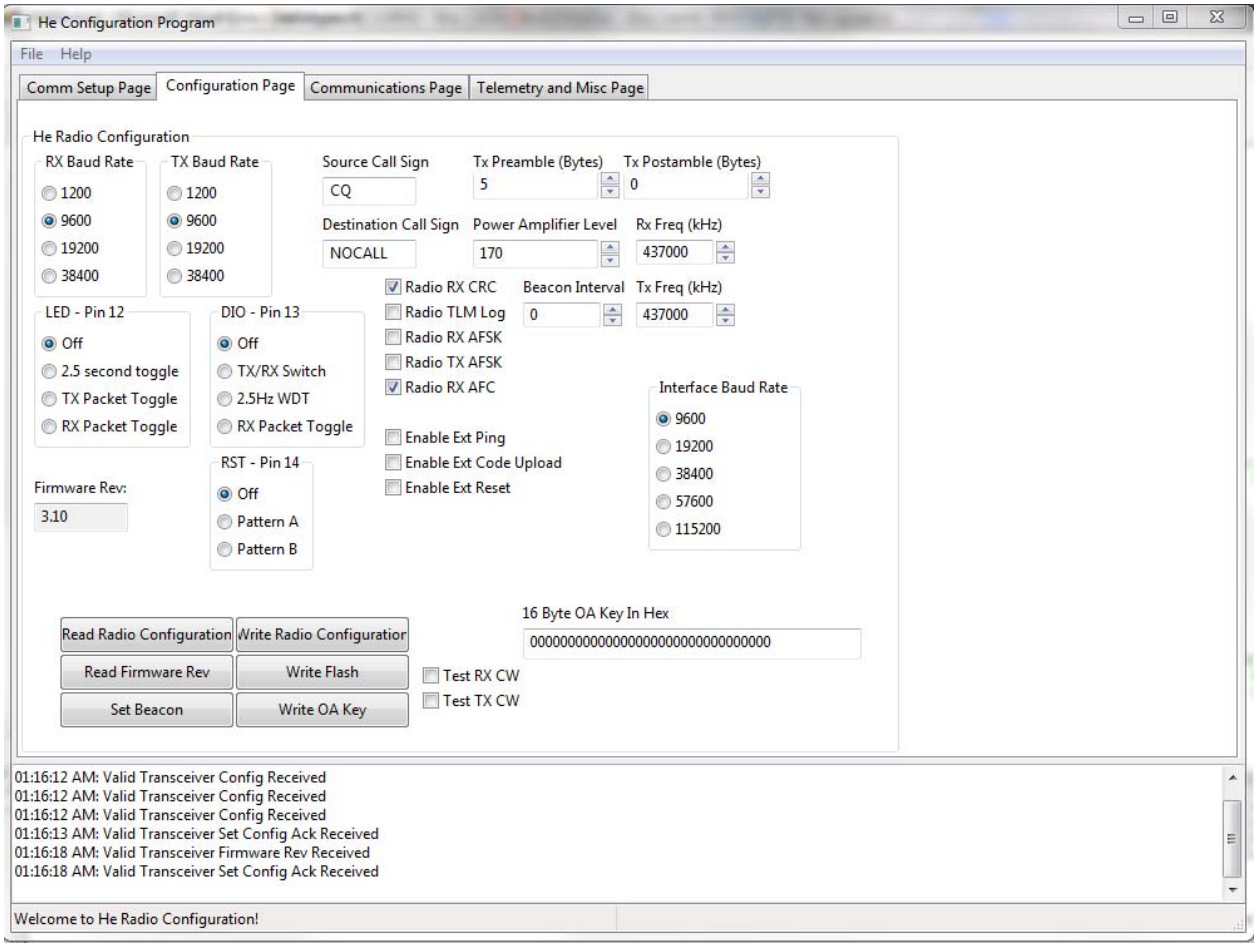

Figure 9 – Configuration Program – Successful Write Configuration / Write Flash

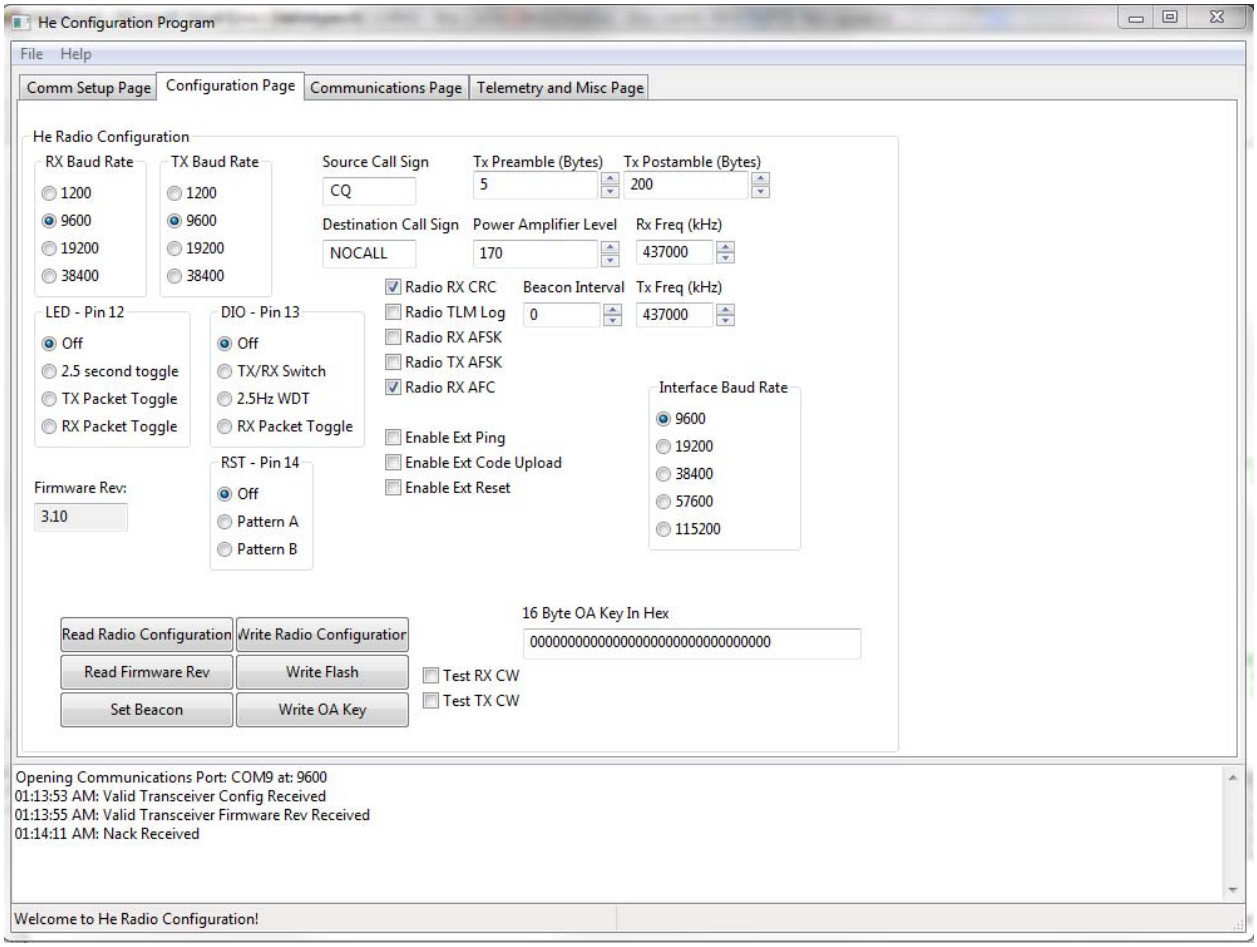

Figure 10 – Configuration Program – Unsuccessful Write Configuration

Step 4 – Configure Handheld Transceiver

The next step is to set the handheld transceiver to transmit or receive on the frequency that the radio was configured for in step 3. Most handhelds with TNCs need to be set to receive or transmit only before trying to communicate between the He-100 and the handheld. As long as this is set, the handheld should be ready to begin sending or receiving signals.

Step 5 – Run / Configure Software Terminal Emulator

To allow the computer to communicate over the USB-to-Serial connection with the handheld transceiver, a software terminal emulator will be needed. Any software terminal emulator can be used to communicate directly to the He-100 radio through the Configuration Program. Tera Term and Hyperterminal are examples of free software terminal emulators that can be downloaded online from various hosts; Tera Term will be used for the screenshot demonstrating successful communication (Figure 12). Regardless of the terminal client, the software should be set up for serial connection and the comm port needs to match the handheld transceiver's comm port (this can be checked in the Device Manager – see the troubleshooting section for help with identifying comm port numbers and changing). In Tera Term, the baud rate for the handheld transceiver needs to be set to the same value as the He-100 in the Configuration Program. The baud rate is set quickly by typing "hbaud 9600" (Figure 12). Tera Term is then ready for communicating between the He-100 radio and the handheld transceiver.

Step 6 – Test Communication between He-100 and Handheld

The last step of the test process is to actually send characters in the direction that has been determined by setting the handheld's frequency (either from the He-100 radio to the handheld or from the handheld to the He-100). The example screenshots shown below in Figure 11 and Figure 12 were taken when transmitting with the He-100 to the handheld transceiver. If testing the transmitting end of the He-100, the field "He Radio Transmit Communications"

should be used to send characters to the handheld transceiver; to issue a transmit of the characters typed into the field, press Enter on the keyboard. In this case, the software terminal emulator should display the text that was sent (Figure 12). If for some reason the text is not received, try moving the handheld farther away from the He-100 (distances greater than 3 feet are recommended) – a 50 ohm load is needed, tuned to the frequency of operation. The buttons under the transmit field can be used as well – where the serial terminal emulator will only receive information when using the "Send Transmit Command" button (Figure 13).

To demonstrate the receiver end of the He-100, the frequency of the handheld transceiver should be set to the same frequency that the He-100's "Rx Freq (kHz)" field is set to. Then the serial terminal emulator can be used to transmit to the He-100. The received characters will appear in the "He Radio Receive Communications" field.

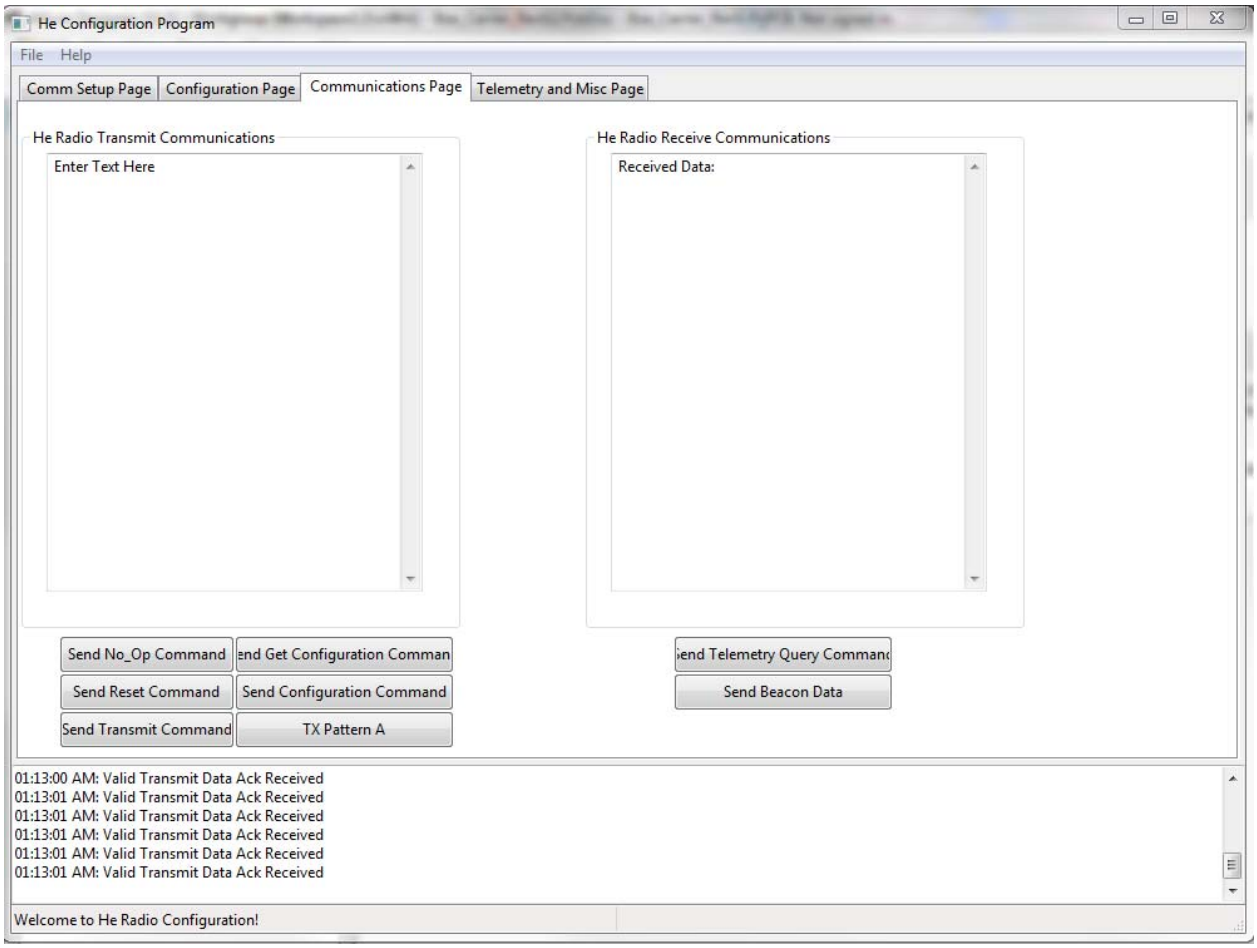
He Configuration Program
File Help
Comm Setup Page
Configuration Page
Communications Page
Telemetry and Misc Page
He Radio Transmit Communications
Enter Text Here
He Radio Receive Communications
Received Data:
Send No_Op Command
end Get Configuration Comman
Send Reset Command
Send Configuration Command
Send Transmit Command
TX Pattern A
end Telemetry Query Comman
Send Beacon Data
01:13:00 AM: Valid Transmit Data Ack Received
01:13:01 AM: Valid Transmit Data Ack Received
01:13:01 AM: Valid Transmit Data Ack Received
01:13:01 AM: Valid Transmit Data Ack Received
01:13:01 AM: Valid Transmit Data Ack Received
01:13:01 AM: Valid Transmit Data Ack Received
Welcome to He Radio Configuration!

Figure 11 – Configuration Program – Transmitting from He-100 to Handheld

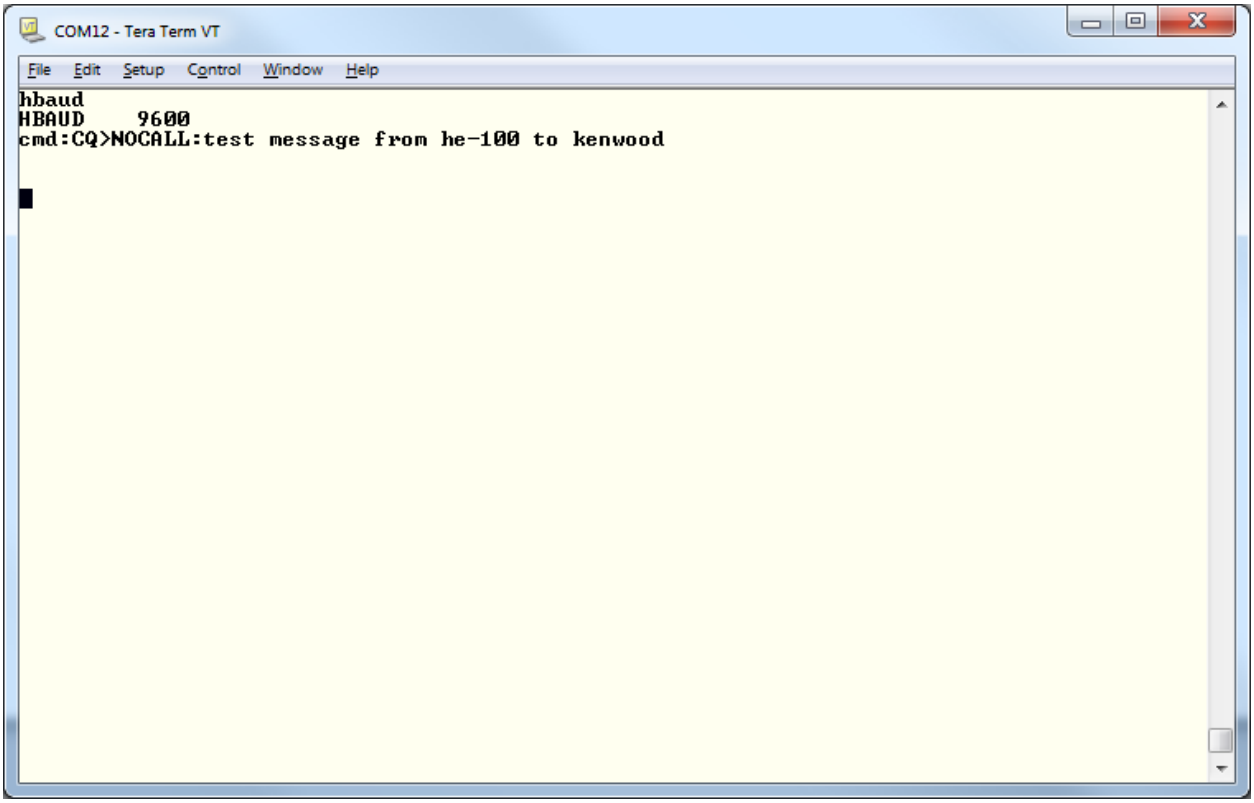

Figure 12 – Tera Term VT – hbaud Set and Successfully Received Message from He-100

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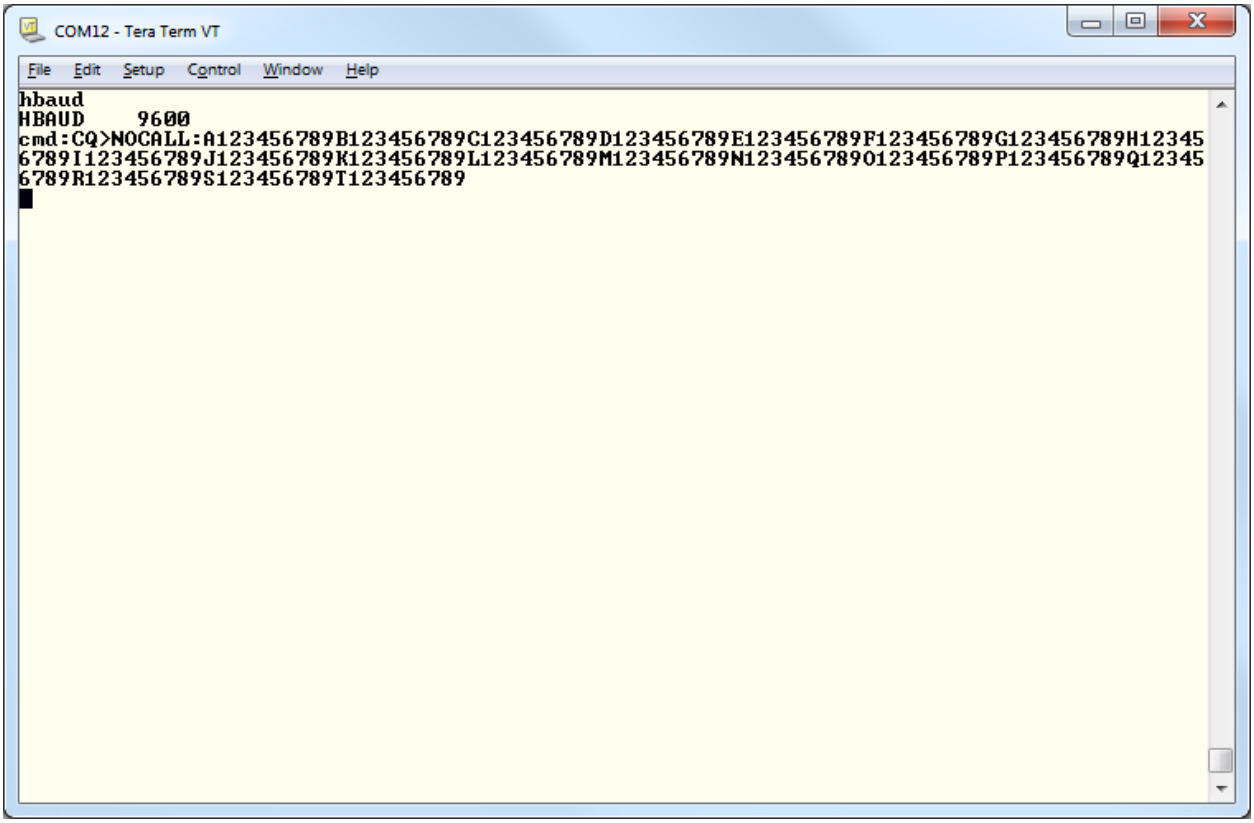

Figure 13 – Tera Term VT – Successfully Received "Send Transmit Command" from He-100

TROUBLESHOOTING

If a connection cannot be established with the radio upon using the Radio Configuration Program, there are a number of things that could be the cause. The following section will help guide the user through common issues that they might encounter.

Serial-to-USB Driver did not properly install

When plugging in the Serial-to-USB cable to the computer, the driver for the radio will try to automatically install. If this fails, the link below has the drivers necessary for the radio to properly communicate over the Serial-to-USB cable to the computer:

http://www.ftdichip.com/Drivers/VCP.htm
For more information on drivers, this FTDI site is also recommended:
http://www.ftdichip.com/Support/Documents/DataSheets/Cables/DS_TTL-232R_CABLES.pdf.

Configuration Program is unable to find COM Port (VCP is too high)

When opening the COM port after connection a computer, the COM port will automatically be selected. Sometimes the computer will select a COM port too high for recognition. To change the COM port to a lower setting, the user must manually do by navigating to the following path (also illustrated by the screenshots following):

Control Panel > Device Manager > Ports (COM & LPT) > USB Serial Port (COM#) [Properties] > Port Settings > Advanced > COM Port Number.

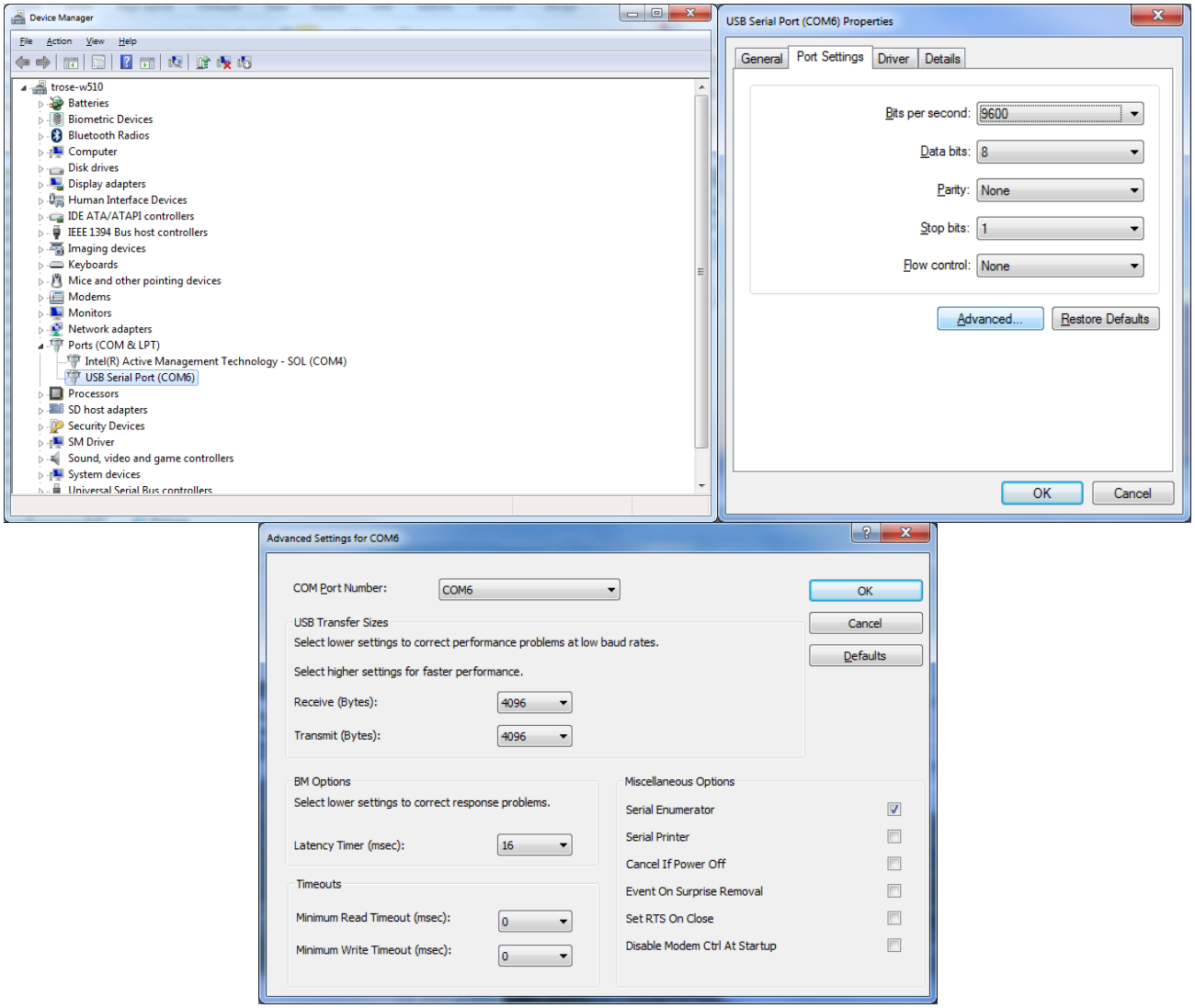

Figure 14 – Path to Manually Change COM Port

TRADEMARKS

In progress.

DISCLAIMER

All information in this document is subject to change at anytime. Look for continued updates at: http://www.astrodev.com/

Helium radios are sold as test devices and require users to gain experimental license from the FCC for use in terrestrial and CSK satellite missions.

NOTES

The He-100 Breakout Board, shown in Figure 3, features four test points for receive and transmit.

The Comm Port should always be closed prior to closing the program.